

will exclude it or disregard it as having no probative force.

So let the testimony be produced.

DR. ROBERT E. KUTTNER, called as a witness by the intervenors and having been duly sworn, testified as follows:

DIRECT EXAMINATION

BY MR. FITZMAN:

Q. Give the reporter your name, your occupation, and your address.

A. Robert E. Kuttner, I teach at the Creighton School of Medicine, Omaha, Nebraska.

Q. Will you state for the record, Doctor, briefly something about the training you have received and the degrees you have received?

A. I have a doctorate in zoology from the University of Connecticut. I attended from 1952 until 1958. I have spent three years in post graduate work in brain chemistry at a mental hospital in Connecticut, Institute of Living.

Q. Now, you're not talking to the reporter. You're talking to the people in the back of the room.

A. And for the past three years I have been teaching normal biology and preclinical sciences, department of Creighton University School of Medicine. And I have done research in brain chemistry and biochemical anthropology, and I have done some work in biological and psychological areas relative to Man.

Q. A little louder as you go.

Now, will you please state for the record of what societies you are a member? Or some of them?

A. American Association for the Advancement of Science;

The International Institute of Sociology; Nebraska Academy of Science; American Chemical Society; Sigma XI, honorary professional society, and various other --- The Eugenics Society of the United States; Eugenics Society of Great Britain.

Q. Do you hold any offices in any scientific societies at this time?

A. I was formerly president of the International Association for the Advancement of Ethnology and Eugenics, and I 'm still on the board of directors.

Q. Doctor, have you published a number of works in your field in physiological chemistry, neurochemistry, biology, psychology, and so on?

A. Yes, sir.

MR. PITTMAN: I tender at this time, Your Honor, the biographical statement, together with a list of the publications, notes and communications that Dr. Kuttner has authored in his field.

THE COURT: Let it be received in evidence and marked as an exhibit.

(Same received in evidence and marked as Internenor's Exhibit No. 12)

MR. PITTMAN: Will the Court now hold Dr. Kuttner qualified as an expert?

THE COURT: Yes. He is qualified as an expert.

Q. Dr. Kuttner, in the studies you have made, are you familiar with the biological and physiological differences that exist between races and the bases therefor?

A. Yes, I am.

Q. Will you state what some of those processes, physical and biological processes, are by which the traits or characteristics are handed down from generation to generation? And we realize that you could talk about that for a week, but will you please talk about it briefly and summarize it, if you can?

A. Well, the subject you are referring to is the branch of zoology known as genetics. This field of study is devoted to elucidating the mechanisms by which physical traits and psychological traits are passed from parent to offspring. And for the past 75 years or more, this process has been in the hands of specialists in various branches of biology, and in the present time these various branches have contributed to a common understanding of the subject, which includes information from chemistry, biology, botany, histology,

Now, to put this in lay language, we know that in every cell there is a nucleus. In every nucleus of every body cell, barring certain exceptions like the red cell, there are

elements called chromosomes, that when a cell divides, these chromosomes divide also. And these chromosomes are known to control the inheritance of traits. They store the information by which a new cell builds itself. They are the blueprints. These chromosomes are further subdivided into units called genes, and these genes, by chemical analysis and by other means, have been shown to contain substances called nucleic acids.

Now, we have gotten down to the very basic molecular structure. These nucleic acids are long molecules, long chains, and they have as part of their structure various organic bases, and the arrangement of these bases, the sequences of these bases, provide the code by which the cell stores the information it needs to build itself. These are nucleic acid triplets, and each triplet informs the synthetic machinery of the cell what amino acids to place in what position in a protein.

So we move now from the unit of inheritance, the nucleic acid, to protein. Now, proteins are the most important element in protoplasm, and some of these proteins have very active functions in the cell. They are catalysts, and these in turn are called enzymes.

Now, the activity of these enzymes determines metabolism, and metabolism, to define that briefly, is the synthesis or breakdown of cell components -- nutritional

elements and structural elements in the cell. By controlling the formation and the proportion of enzymes made, which enzymes are made, how much, whether are normal or abnormal enzymes -- because we do have instances where enzymes have been modified by some accident and, therefore, their activity is lost -- but by regulating the formation, the amount, the quality of these catalysts in the cells, we thereby regulate all the activities of the cells, of all cells, and this includes not only somatic cells of the body in general, but also the cells that are associated with mental functions, which would include all the cells of the central nervous system, the peripheral nervous system, and likewise the same process would apply to endocrine glands, which also regulate body activity and mental activity.

I think I have summarized.

Q. Now, you come eventually, do you not, to the determination of individual differences in human beings? Is that correct?

A. Yes. The individual differences would ultimately be traced to the operation of the same forces in the cell, the cells of that individual or that organism. We would picture this by a reference to, say, bone, that if the enzymes that regulate the formation of bone were very active, we would have more bone growth; if the endocrine substances were very active, that would play a role in this formation, then we would have increased growth. On the other hand, other

systems in the body would likewise be responsible. I picked for an example the bone, but I could have picked any example to illustrate this point. And differences in bone would determine the person's height, or differences in endocrine function would determine how fast he grows and how tall he grows. This would also be determined as metabolism, how fast he burns his food, how active he is. It would determine every biological activity.

Q. Now, Doctor, tell us whether or not the protein molecules and the nucleic acids which you spoke about govern or determine individual differences, and also govern functions, as well as those structural differences.

A. Well, the illustration of bone would have been a demonstration of how a structural element is produced, the quantity of it and the quality of it. The amount of an enzyme form may determine the activity of an organ. If we have inherited a stomach which secretes a lot of acid, this would all be traced back to a genetic element, because originally there was a trait which involved the enhanced production of protein to make a stomach cell. There would have been regulators in that cell which were inherited which would control the amount of stomach acid produced, and we would have by this means bridged the gap between the physiological and the molecular. But to take it a step further, this demonstration has in it a number of steps, and the connection between these steps are the subject matter of many sciences. Briefly, however, if we

were to demonstrate the functional activity with respect to nucleic acid, we could inject these substances into the body or destroy them by some means, and then determine what changes took place in behavior. Likewise, we could destroy them or modify them and search for difference in structure.

So in terms of this original analysis, we have the ability in the enzymes to modify nucleic acid by some means, and then search for resulting change in structure, anatomy, or function.

Q. Now, are there any behavioral differences in animals, we'll say, which we may relate to human beings, which could be correlated with chemical activity in the brain?

A. Well, in the end, of course, the total capacity of the brain depends upon its inherited equipment, the apparatus that you have, and the genetic materials are the basis for the amount of apparatus, the amount of equipment, you have, and the quality of it. To show that nucleic acids play a role, --- this again is very recent work --- one can feed or inject substances into animals or modify the body's mechanism for making these substances, and then search for differences. Now, this has been done from animals ranging in simplicity from the flat worm up to human, but, again, this is very recent. I may illustrate perhaps in between -- the intermediary range between the flat worm and the human might be the laboratory rat. In this case, if you inject certain substances or drugs which are known to interfere

are being produced and examined because of the interest in slowing down cell growth in the field of cancer research. But these same substances when injected into animals very often will interfere with the nucleic acid synthesis in the central nervous system, and thereby produce behavioral changes. Rats treated with such drugs lose the ability to learn certain tasks. Again, feeding the substances into rats for a long period of time -- Now, I'm not referring to the same substances, but feeding the nucleic acids themselves to animals has been reported in recent articles to enhance their learning ability up to a certain point. Likewise, by feeding these substances to persons suffering from degenerative changes in the brain due to old age have been presumably benefitted from it, so far as memory function is concerned.

Q. Would that be a permanent benefit or temporary?

A. This probably would be a temporary one. Again, it's very recent.

Q. Because if it's permanent, I want some.

A. The assessment of the importance of this for these animals is not yet complete.

But what I have tried to make here as a point is that these nucleic acid substances, which are not only the basis for the formation of the heredity of the organism, but they are the blueprints, the information storage depots of the cell, may likewise be the information storage depots of the

central nervous system, where we are not storing biological information, but behavioral information, or something that we have learned.

Q. Now, to shorten that, Doctor, would these various functions and activities of the brain, the endocrine glands, are they under genetic control or under environmental control?

A. Well, they are very certainly under genetic control.

I think I mentioned a little earlier the chain of sequences that occurs between the laying down of the nucleic acid and then the final effect. This is the general answer to this question, and I can't answer it more except to say that the brain is a structure; its function is thought; its function is determined by enzymes, by hormones, by potentials on the membranes, by the general metabolism. Now, this metabolism is the same for the brain as it is for the cells, and we inherit a capacity. We inherit our enzymes' rate of formation. In this way, certainly the function of the brain, its activities, are under genetic control.

Q. May I ask you this, Doctor: Is there any way, or are there any studies that have been made or can be made which will illustrate the fact that behavioral differences are inherited in human beings?

A. Well, of course, we can't study human beings as in the chemical realm very well because of the laws. We can't

operate with human beings as we can with animals; the demonstration with human beings would be impossible in our society.

Q. Something has been said here about twin studies.

A. Well, that is an indirect way, but to answer your question, I think that the way that most people would think of a demonstration would be by analogy from animals. This we can show. We can take animals that have been found to be intelligent, animals that learn rapidly -- a strain of rats -- and then we can take another strain from the same original breed that have been selected for slower learning, or less potential to learn, and study the chemistry of the nervous systems in these animals, and we do find that there are chemical differences that accompany behavioral differences. For instance, in a nerve enzyme called cholinesterase the levels of this enzyme are different in smart rats from the levels in retarded rats, and this trait ---

Q. --- You might state, if you will, Doctor, in that experiment by which that was determined, how do you find the difference between the dull rats and the smart rats?

A. Well, it is an artificial distinction based upon a single task. There are many ways you can test a rat. One way is to run them through a maze, and they learn very quickly whether there is a reward in this alley or another alley, and when they learn this task they have been tested by

criteria and are assumed to be intelligent. How many times you have to run them before they learn is a measure of their intelligence. Then you can take from the same brood other rats which are less successful in finding the motivating factor for their taking the test. The rats so separated when bred together --- these two groups are bred together --- preserve their trait of fast or slow learning, and from generation to generation --- and for rat generations, many many dozens --- the traits persist. Likewise, the chemical trait.

- Q. About how many years did it take to carry this experiment with rats?
- A. Well, I don't recall because this was done many, many decades ago; the initial selection and breeding experiment was done in California decades ago. The strains still exist, and the difference in learning still persists, and the difference in the chemistry, which was only discovered perhaps ten years ago, is still present.
- Q. How long ago did you say this difference in chemistry was discovered? Did you say chemistry?
- A. Chemistry. The difference in chemistry was discovered about ten years ago in these brains.
- Q. Since about 1954?
- A. Let's put it about that date. A little later possibly.
- Q. Now, are you familiar with an article by Sir Cyril Burt, that deals with that subject, "The Inheritance of Mental

Ability"?

A. Yes, I am familiar with that article, and this is another means of ---

Q. --- First, tell us who Dr. Burt was.

A. Dr. Burt was a psychologist employed by the London County School Board approximately 50 years ago to study the learning abilities of school children in England. And this he did for the greater part of his life, and he finally summarized his findings, and this was published in THE AMERICAN PSYCHOLOGIST, Vol. 13, January '51.

Q. Is that '51 or '58?

A. '58. I'm sorry. This article was entitled "The Inheritance of Mental Ability" and culminates his act of life. He had already retired.

Q. Would you state for the record the conclusions reached by Sir Cyril Burt, Dr. Burt, with which you agree on the subject you have been discussing?

A. Well, so far as his work is relevant to my field, he was employing a method of study which was designed to determine the components of heredity and the components of environmental influences that made up the mental abilities of school children. He was searching for a way of determining what relative amounts we could ascribe to these two different mechanisms of influencing children - environment and genetic components - in the whole make-up of mental ability; so he employed for his study children drawn from

different schools and determined the closeness of their genetic association and sought thereby to see if this closeness was correlated with their intelligence. He was using, in other words, the twin study method of determining the degree of genetic influence in a trait. This method is used not only for mental, but also physical traits. We all know that identical twins are called identical because they are identical. This we can see visibly. We know that some of the invisible traits, the ones we don't notice, like fingerprints, blood types, are also identical. The question is, are the mental abilities also identical? This is hard to tell, and the only way you can do this is to test these individuals with formal examinations designed for measuring various capacities of the brain.

So he took such identical twins from the school system of London, and he took besides the identical twins that were reared apart. This is, of course, something that happens, unfortunately; the twins were separated at birth, or shortly after; and they are genetically identical, all descended from one egg, the same egg; they share the same prenatal experience, and their genetic equipment is identical, since they are the same cell divided twice and became two individuals; but now, when these individuals are born, they are separated in some instances, perhaps through the inability of the mother to support the two children, or for other reasons, and so he had in his samples some such individuals also.

THE COURT: Doctor, just remember where you are leaving off, and we are going to take a ten minute recess.

(Ten minute recess)

After Recess

MR. PITMAN CONTINUES:

Q. Dr. Kuttner, you were testifying concerning Dr. Burt's study entitled "The Inheritance of Mental Ability," and I wonder if you would not for us summarize the results of that study. I believe you have explained how it was conducted, but if you have not fully done that, continue that, and then summarize the results and tell us whether or not you agree with his conclusions.

A. I was explaining that Dr. Burt selected out of the school population individuals whose genetic association varied. There were in that group identical twins. These are really two persons who share their heredity completely because they all were derived from one egg, one fertilized egg. And he had two types of identical twins: he had the identical twin that was reared in the same home; and he had the identical twins that were separated. This was the second kind.

Now, when you have an identical twin reared in the same home, raised in the same home, you have individuals who share heredity; they also share a common environment insofar as the same parental influence, same family influence.

same local community, same school. When the twins are separated, there is a different person raising the twins; they probably go to different schools; probably there are different economic levels in the home. This then varies the environmental influence, but, of course, the genetic influence can't be modified.

Q. In other words, the socio-economic factors are different where they are reared apart?

A. That's correct.

Q. And if they are reared together, they are the same.

A. That's right.

Q. Go ahead.

A. For instance, the grandmother may be raising one twin and indulging that twin, whereas the mother may be very strict with the one left with her.

In addition to identical twins, he also had fraternal twins or twins who were just like brother and sister, born at the same time but not from the same egg. These two individuals are not any more closely linked in genetic traits than brothers or sisters. There were two eggs fertilized at one time, and these are two individuals. And he had groups of non-identical twins that were reared together.

Finally, --- Well, not finally, but he had siblings, ordinary brothers and sisters but not fraternal twins, that were reared together; and he had siblings, brothers and

sisters, who were reared apart; and finally, he had the regular school population of unrelated children. And these completed his study.

So he tested these individuals with various tests employed in England --- some of them also employed in this country --- and showed that the correlation between their test performance followed very closely the closeness of their genetic link, that the identical twins scored on these exams to about the same degree of proficiency, to about the same extent. The correlation in terms of numbers was .9 and higher.

Q. How much?

A. Well, as far as various intelligence tests, he gives numbers like .944, .921, .925. --- That's "Final Assessment, .925." This is considered a very high correlation. As a matter of fact, if the same individual were to take the test twice -- if a single individual took this exam today and then was retested two or three days later, his scores on these exams would not be any closer than the two identical twins taking it at one time. So it's actually like one person taking the exam when identical twins take it.

When the twins were separated, there was also a very high correlation. Now, these identical twins when separated also scored very high in this correlation. They were close to .9. The actual number is .876, the Final Assessment.

This means that though these twins were separated, their performance was almost identical, a duplicate.

Now, comparing this correlation to that of non-identical twins reared together, or to brothers and sisters reared together, we have sums like .551 and .538. What this means is that identical twins, even when separated, score almost identical grades on these exams for intelligence, for general intelligence, while individuals who are not closer related than brother and sister or fraternal twins, 2-egg twins, they score much less alike. Now, when identical twins are separated and we have a completely different environment, and when non-identical twins or siblings - brothers and sisters - are reared together, we have the same environmental influences, but a much more distant genetic link, and yet though the environment remains close for the non-identical twins reared together or for brothers and sisters, still the identical twins score much closer grades to each other even though reared apart. Now, this demonstrates that the genetic components in learning ability, in mental ability, are more important than the environmental influence.

Q. Now, can you state that in round figures?

A. Well, on page 9 of this article, Burt does state this in terms of numbers.

Q. Will you read that, for the record?

A. I will. He begins, "From Table 2..." He refers to a table

from which he draws his data:

"...it will be seen that, with the crude test results, taken just as they stand, nearly 23% of the total variance appears due to non-genetic influences, i.e., to environment or to unreliability, and about 77% to genetic factors; ..."

And he continues:

"...with the adjusted assessments only about 12% (or slightly more) is apparently due to non-genetic influences and 88% to genetic factors."

Q. What does he mean there when he says --- I believe that study has been used, Doctor, by some other witness, and he stated a different figure from that 88.

A. 88%, which means that the influence of the genetic element counts almost for the entire test performance, and only 12 percent environmental influence. What this means is that this is almost entirely a physical trait, or inherent as a physical trait. Now, the numbers here, for the two numbers he gives -- 77% and 88% -- are both very large, both very convincing; but he is able to adjust his figure, his actual crude data figure of 77% to 88% by making certain corrections.

And he corrects ---

Q. Now, what does that mean in terms of mental ability, or educability?

A. I think what --- Well, I don't know if I finished what I was going to say here on this number.

In testing children, you have to know a little about them

when they take their examination, and there are cases where maltreatment at home might affect the child's performance, or whether the background of the child is such that he is not able to perform in school for reasons not connected with his genetic ability; so by interviewing these students and checking on their homes and so forth, he was able to eliminate certain individuals from the sample. When he does that, then he reaches the number of 88%.

And this means, this adjustment here that he makes, even though this adjustment ^{not} is/important --- if you didn't make it, it doesn't change the picture so far as the meaning of my testimony is concerned, because 77% is not that different from 88%. It means that the mental ability that these students display in terms of general intelligence is very largely, almost exclusively, due to their physical inheritance. That's what it means.

- Q. Is there anything that can be done to change the inheritance of children? In other words, that 88% could not be changed by any method of instruction? Is that right?
- A. Well, it is possible to destroy some of this correlation environmentally. If you beat the children before they take the exam, they will be distracted. And this is actually one thing he is checking for; seeing that the child is fed, so that when he is taking the exam there is no distraction due to hunger. You can lower the correlation, but you can't change the native ability. However, you measure it at the

it's 77 or 83 percent, the fact remains that it is genetic, and changing the genetic ability is something that is beyond our science.

Q. Do you have any other studies along that same line, Doctor, that come to substantially the same conclusion?

A. Well, in the same study there are scattered references, but I don't think that I have to quote them here any further.

The interesting thing about the Burt study is that he employed the twin study method, which is one of the finest or least ambiguous methods of demonstrating the connection between genetic endowment and some behavioral or some anatomical traits.

Now, the other study that I have here which bears on this subject is —

Q. — Before you go to the other, Doctor, I would like to identify "The Inheritance of Mental Ability," by Dr. Burt, for the record, please.

THE COURT: Was that for identification?

MR. PITTMAN: We offer it in evidence.

THE COURT: Very well. Let it be received in evidence.

(Same received in evidence and marked as Intervenor's Exhibit No. 13)

Q. Now, proceed, Doctor.

A. Well, along the lines of twin studies, there is another article here which illuminates the preceding article and helps validate it. This article is entitled "Twins Brought Up Apart."

Q. Would you state the author of that article and when it was published? Is that the one in EUGENICS REVIEW?

A. That's correct, EUGENICS REVIEW of July, 1958, and the author is James Shields of the Genetics Unit of the Institute of Psychiatry, Maudsley Hospital, London, England.

Q. Now, both of these studies, the twin studies, were made in England.

A. That's correct.

Q. And they were made since 1954?

A. That's right. This article has been published in 1958.

Q. All right. Tell us about that study.

A. This study originated by a television appeal to English listeners or viewers that if they were one member of an identical twin pair, they should come forward and volunteer for research. By this means, this wide publicity, Shields obtained a large group of identical twins that were separated at birth, or very shortly thereafter. He obtained a sample size twice as large as the preceding one, which I'm not going to quote. He obtained a total group of 38 --- I believe that's the number --- 38 pairs of identical twins that were separated at birth or shortly thereafter. Some of these twins had been separated for the entire childhood and adult life and never met until they were introduced by the sponsors of this research. One twin would come in in response to the broadcast, and

they would locate the other twin in some cases living as far apart as Denmark and Chile.

And the importance of this paper is that this separation here is complete. This maximizes the environmental factor. These identical twins were reared apart by completely different parties. In some cases, perhaps, it might have been a grandmother or an aunt, or in other cases they might have been reared apart separated by oceans. The environmental difference was very pronounced here. They weren't, in most cases, even living in the same city, as in the case of Burt who drew his samples from the schoolrooms.

This study then is important because of the separation factor, which is so complete, so total, and therefore emphasizes the environmental factor, and also because it's such a large group, 38 pairs, the largest group studied, although since then he has found ----

- Q. What was the conclusion reached as a result of that study?
- A. Shields likewise gave intelligence tests, and he found that identical twins when raised apart still resembled one another more closely than ordinary siblings raised in the same household. The correlation was again very high, the numbers of .77, .74. This is very high compared to the correlation figures given for siblings raised in the same home, which is .5. These numbers may differ a little bit, but then, of course, the testing conditions differ and the type of environment in the test situation differs, and there may be some

factors there, but again his correlation is very high. And it shows, as Shields emphasizes throughout the paper, that the genetic factor is predominant in the inheritance of intelligence, or test performance that measured the intelligence.

Q. Did he come to the conclusion finally that environment does not fundamentally alter the personality of the child?

A. Well, I said that he measured intelligence. Now, actually, his actual interest was personality. Of course, in this case, the report is based on self assessment and on observation. It's not a metrical quality you could put in numbers, but there were striking resemblances in the behavioral traits. The personality traits of these twin pairs, even though separated -- the type of mental quirks, neurotic symptoms a person showed, appeared in the other twin despite the fact that they were raised in different environments. The tastes for music and so forth were sometimes similar; their mannerisms were similar; and again this emphasized the importance of the genetic element.

And he adds, on page 121 of this article, and I quote it:

"From the material as a whole one gains the impression that the personality of the mother and her methods of child rearing can vary quite a considerable degree without fundamentally altering the personality of the child."

--- Because these were in fact different mothers raising these children. And this underlines and supports the work of Burt, who had a smaller sample of identical twins, and these identical twins that Burt worked with for the most part came from the London school environment. Many of Shield's cases, of course, involved wide separation -- one in an urban community, one in a rural community -- and yet the type of responses that these people gave to interview situations were very similar.

So again we stress the importance of the genetic element here in the intelligence-personality.

MR. PITTMAN: I tender this study by James Shields for identification and admission into the record.

THE COURT: Let it be received in evidence.

(Same received in evidence and marked as Intervenor's Exhibit No. 14)

Q. Doctor, are you familiar with any articles, any other articles, of this nature, "The Inheritance and Nature of Extraversion"?

A. Well, the article I have here ---

Q. What does that mean, "extraversion"?

A. It's a measure of a personality trait.

Q. Do you have articles on that with which you agree?

A. Well, I have an article here that I am going to cite. The reason for it, of course, I think will be evident. This article is also from EUGENICS REVIEW.

Q. What is the date of that?

A. April, 1956.

Q. That is, of course, since 1954. Now, go ahead and tell us --

A. The title of this article is "The Inheritance and Nature of Extraversion." The author is H. J. Eysenck.

Now, this article is likewise devoted to twin study, and Eysenck is a very well known and competent psychologist in England.

Q. State for the record where this paper was first read.

A. It was at the meeting of the Eugenics Society in 1955, December 7th -- members' meeting of the Eugenics Society.

Q. Go ahead.

A. The work that Eysenck carried out on these twins, he obtained them from the area of greater London, and he carried out a wide battery of examinations and found that identical twins --- now, these were not separated twins; they were identical twins in the same environment --- performed on various intelligence tests -- obtained scores that were very close. Now, this confirms the previous references I have made.

Likewise, he gave tests for autonomic function. Autonomic function is related to endocrine function, neuro-endocrine and nervous function, and things like blood pressure, for instance, and temperature, and responses to stimuli. These things are part of the spectrum of things one would measure when interested in determining autonomic

function. He gave such tests.

Likewise, he gave personality tests to measure introversion and extraversion, and again, these are personality traits that I mentioned. This trait -- It's not important, I suppose, to go into what the traits are, but the outgoing person and the inward-looking person would define these traits. Well, there are means of scaling these qualities in individuals, and one can employ various tests.

Q. What is the significance of his findings?

A. Well, the significance is that a personality trait --- Now, I mentioned already the intelligence and autonomic tests. Now, the personality test of extraversion. These three items he found to be genetically determined. They were very close in scores, in scores obtained. These identical twins in these studies obtained scores on these examinations that were very close -- high enough correlation to indicate the genetic components being dominant.

So these three things, autonomic ability, intelligence, extraversion-introversion, were found by Eysenck to be correlated with the genetic components. This is important because personality makes up part of the total individual; it's not just intelligence. It's a temperamental trait that is shown to pass on in the process of inheritance in the same way as a physical trait or a mental trait. We have here a personality trait that is found to be inherited, by twin study method. This means that in the end we have these

genetic elements in the cell as the primary responsible factor in this. Twins obtained the same genetic equipment and displayed the same personalities, so far as this measure is concerned.

The other thing that is interesting here is that the autonomic test indicated that the genetic element is very strong. Autonomic is in part a member or part of the team that makes up the endocrine system. We have, I think, mentioned in the earlier part of my testimony that endocrines are related to intelligence; they are one way of regulating cell metabolism, and likewise they influence the brain, and certain endocrine changes can affect learning or wipe out the ability to learn. The classical example there is cretinism, which I should have mentioned earlier. The absence of a hormone will make a person an idiot, and yet the replacement of this hormone will restore to him his normal function. This is an extreme example, but we know that the endocrine system, the neuro-endocrine system, the autonomic functions that are part of the peripheral nervous system are all inherited. Of course, he has measured only this single component, and he has demonstrated, however, with this single component the extraversion factor, that there is a very high dependence upon the genetic closeness, which, in turn, demonstrates the importance of genetic element in manifesting this trait.

Now, I can cite certain parts of this article here that summarizes some of this.

Q. I don't believe you need to do that. You testify, do you, Doctor, that the findings of this gentleman Eysenck correlate with the findings made with respect to the twins to which you have testified, except they involve different characteristics?

A. They agree, and they extend the work. They agree with the preceding work, and they extend it to include the personality factor, which Shields himself brought up but did not quantify. He based his conclusions upon interpretation and self-assessment. This man measured with tests and obtained a number, which one to manipulate according to symmetrical quality.

Q. It moves the same frontier of knowledges a little bit further back in another area?

A. That is correct.

Q. That's right?

A. In an equally important area, the personality being as important as the intelligence in day to day operations of society.

MR. PITTMAN: I'd like to identify this article for the record, please, and offer it in evidence.

THE COURT: Let it be received in evidence.

(Same received in evidence and marked as Intervenor's Exhibit No. 15)

Q. Now, Doctor, in our efforts to move back the frontiers of knowledge a little more than in recent years, I call your attention a study by Steven G. Vandenberg and ask if you are familiar with that study, "The Hereditary Abilities Study: Hereditary Components in a Psychological Test Battery"?

A. Yes.

Q. When was that study published, Doctor?

A. That was published in June of 1962.

Q. What publication?

A. In the AMERICAN JOURNAL OF HUMAN GENETICS.

Q. What is the title of that article?

A. "The Hereditary Abilities Study: Hereditary Components in a Psychological Test Battery."

Q. Have you read that article or studied it recently enough to give us the benefit of the conclusions?

A. This study originated with a group of twins, and physical, anthropological qualities were measured -- components -- and it was extended by Vandenberg to include aspects of brain function.

The importance of this study hangs upon the fact that, unlike the previous studies where general intelligence was measured, Vandenberg broke down the general factors into components, and he separated out from the arsenal of psychology and physiology a total of 117 separate test devices or scoring devices. He broke down the factor of

intelligence into subdivisions or specific factors, and he has a total of 117 separate scores from various categories. Some were drawn from the usual mental abilities tests, like verbal ability, mathematical ability, computational skills, phrase comprehension, and then various other tests that measure your ability to reason, motor skills, perceptual skills, sensory tests, and measures of other things -- personalities and musical tastes, and so forth. And he took 117 such scores and administered them to 45 pairs of identical twins and 37 pairs of fraternal twins from high schools in Dearborn and Detroit.

This is an American study. The study was performed at the University of Michigan, the Institute of Human Biology.

And he found that with varying degrees of significance, but all the data being significant, he found that almost half of these tests showed the operation of genetic factor being the significant factor. In other cases, about half, or slightly more than half, he did reach a level of significance. Some of these tests, perhaps tapping with the finger in time with the music, and so forth, these were not conditioned, were not related to the genetic factor, or might have been environmental; but almost half, 44 percent of the testees of the 117 were shown to have genetic components important or predominant. At least, they reached the level of significance by statistical tests.

And he concludes, or he makes this statement here:

"The results reported indicate that hereditary factors play a role in many areas of human skilled performances, often in spite of the fact that these skills are highly practiced."

In other words, this twin study method has shown some skills of the 117 that he enumerates, though they could be, in the opinion of the common man, acquired by practice, still a degree of performance and a degree of skill was limited or controlled by the genetic inheritance of these twins.

That is the importance of the test, the fact that he has demonstrated the separate components, the specific factors, instead of general intelligence, and broken them down and showed which were highly correlated with genetics and which were loosely or not at all correlated with genetics.

MR. PITTMAN: I tender this study by Vandenberg in evidence.

THE COURT: Let it be received.

(Same received in evidence and marked as Intervenor's Exhibit No. 16)

Q. Now, each of the studies concerning which you have testified are quite recent studies, so far. After you reviewed these recent studies, have you reached any conclusion regarding individual human differences in behavior and psychological traits, and whether or not they are more determined by

heredity or environment? --- Before I ask you that question though, I believe I should ask you this:

Do you know of any other new material, before I ask for that conclusion, that you would like to refer to or discuss before giving your final conclusion?

A. Well, I can answer both of those questions at once.

I do have here an article which reviewed this entire field, and I accept as my conclusion, the conclusion of this article.

Q. All right, if you would like to use that, you may state the substance of it, please.

A. This is the most recent summary of this entire area, and it was published in SCIENCE, December 13, 1963, Volume 142, entitled "Genetics and Intelligence -- A Review."

Now, this was published by the Department of Medical Genetics of New York State Psychiatric Institute.

Q. Would you please, Doctor, since I don't have a copy, read that portion of that recent article that you believe relevant and material in arriving at the conclusion which you have come to?

A. Well, I will read the abstract, which is in this journal the equivalent of the summary.

Q. All right.

A. "A survey of the literature of the past fifty years reveals remarkable consistency in the accumulated data relating mental functioning to genetic potentials. Intergroup resemblance

in intellectual ability increases in proportion to the degree of genetic relationship."

That's the end of the quote.

Now, this is shown in a table here, and one gets the range of the relationship. At the same time, one gets the range of the test criteria. Now, this total study reviewed a total of 52 separate studies covering a 50 year period of research, and it was found that, to re-state the abstract by looking at this table here, this figure, that the degree of correlation between intelligence and mental traits is not too great between people who are not related. We wouldn't expect that. By accident we might find two people equally bright, but we don't expect it from a random sample of a random population. When there is a foster parent-child relationship, there is a slight degree of influence here upon intelligence. The foster parent, if he's well educated, will try to train and raise the child in a way that will reflect his own abilities. But that relationship is not as close as that between parent and child, because not a genetic element enters into it. There will be the parent-child correlation here because the genetic element is there and also the motivation to educate the child to at least the level you yourself have. Then when you check siblings, now you are looking for genetic traits in the same environment, and you find there is a fair correlation when

they are reared together; the intelligence correlates to about the .5 level. This is what we find for physical traits also.

When we come once again to the twin studies of the identical pairs, we find that we have the highest level of correlation, a .9. This repeats and recites these previous studies. The numbers are always very close and very high.

And working back a little bit now, the reared-apart twin, identical twin, is slightly less matched with his other member of the pair, but still almost completely genetic.

And the 2-egg twin doesn't correlate his factors with the other member of the twins to a degree much higher than siblings reared together.

So we have --- I have reviewed here, and I accept this as my conclusion, the conclusion in this paper that genetic factors are predominant in the mental abilities field so far as we can measure. This repeats what I have said before and emphasizes what I have said before, that the genetic element ---

- Q. Do you know of any modern authority that reaches the conclusion contrary to the conclusions you have just now reached, to the effect that heredity, rather than environment, is the controlling factor?
- A. Do I know of a modern authority ----?
- Q. --- Contrary to those you have read to the effect that genetics

is the controlling factor, rather than environment?

A. Well, I have heard of people who would not accept this type of evidence.

Q. Well, when I say "modern authority," I mean a study. Do you know of any study?

A. Well, not with twins. I mean, we have people who disagree with these results for reasons probably separate from the quality of the evidence. I understand that there are still people in Russia that would disagree with this; that's the Lysenko school of genetics, which has no parallel in the civilized world.

Q. Has he ever been recognized as an authority in the field of genetics?

A. He has been recognized by Stalin.

Q. Has he ever been recognized by any reputable scientist outside of Russia, as an authority in genetics?

A. He has been defended by Communist scientists, but, from attack, but this is a field that I can't claim expert knowledge in. But I do know of one individual in England defended him long ago, but this was not a point of interest to me, and I'm not sure of the name.

Q. Lysenko/^{is}the so-called scientist who came to the conclusion, without ever having studied at any of the universities and without ever having studied genetics to any great extent, that you could, through environmental factors, change winter wheat to spring wheat?

- A. Yes, he had something to do with this field, but I have no knowledge of his qualifications except they weren't very many, and I don't know what his credentials are.

In this country I know of no authority in the field.

Well, to return to Lysenko, he never worked with twins. And in this country I know of no authority that ^{is} recognized in the field that rejects this work, as such, though there are some people who would evaluate it as less conclusive or less striking. There are such people. But I'm not aware of who they are.

- Q. I will ask you this: Are the findings you have just stated contrary to what is generally known as the equalitarian theory in some respects; so that if a person is an equalitarian, he might be willing to accept dogma, rather than facts?

- A. Well, I don't quite know --- We would have to define equalitarian very carefully before I could answer that question.

- Q. In other words, one that believes rigidly that all men are created equal? Would that define an equalitarian?

- A. Well, this might be one possible definition. I would say I can't speak for what the equalitarian would believe, but I would say, if I have to answer that question, that I suspect that a person who was dogmatic about some social or political or economic issues might not credit this type

of work with the importance that it deserves, but I can't say how or to what degree this credit would be withdrawn or not acknowledged; I can't answer that.

Q. Thank you very much, Doctor.

THE COURT: Is this examination going to extend much longer?

MR. PITTMAN: It will extend beyond four-thirty.

THE COURT: Very well. I believe we will take an adjournment at this point until nine o'clock tomorrow morning.

(Whereupon the trial was recessed until the following morning)

THURSDAY, MAY 21, 1964, AT 9:00 A.M. THE TRIAL WAS RESUMED.

THE COURT: Very well. Let the witness take the stand.

MR. PITTMAN: We hope to get through in three additional hours with the testimony, Your Honor.

THE COURT: Very well.

(MR. PITTMAN CONTINUES EXAMINATION OF DR. KUTTNER:)

Q. Dr. Kuttner, you completed your testimony about the twin studies yesterday, did you not?

A. Yes, sir.

Q. -- Illustrating the influence of environment as opposed to the influence of genetics?

A. Yes, sir.

Q. All right.

Now, I will ask you, Doctor, as briefly as you can to address yourself to the subject of how races of men, of people, have been formed throughout the ages, what influences have been brought to bear upon the formation of races.

A. The various mechanisms by which races arose have been catalogued, and I think the principal one of interest is the process of selection. We have the modern evolutionary theory which explains that groups of individuals who have certain traits uncommon; a certain population that possesses common ancestry would naturally have common traits. And if these traits, attributes, be they physical or mental, are adjusted to the conditions under which that population may live, then we expect that that population would thrive. If the traits are not particularly advantageous or if they result in a maladaptation or maladjustment with the environment, then we would expect in due time that this population would be diminished; it would be less successful in fitting into the environmental circumstances. Now, this is the main process.

Q. May I ask you a scientific question:

Suppose a tribe of Eskimoes should be dropped into the heart of Africa, what is likely to happen to those Eskimoes?

A. Well, ---

Q. -- Over a period of time.

A. We would expect a certain amount of attrition to set in at once, because there are diseases in the tropical regions to which Eskimoes are likely to have low resistance.

Q. Where would they get their polar bears?

A. Their what?

Q. Where would they get their meat?

A. Well, they would adjust probably to the fact that the source of food has to change. This would be a lesser problem. They would merely have to adjust their taste. But the important things would be that their physiology, which is adjusted to a colder region, would not have any special advantage in the tropics; it might even be harmful, particularly their resistance to disease, their resistance to heat. In case the temperature extremes rise, they are likely to develop fevers, ---

Q. Suppose you put a thousand Negroes in the Arctic region, from Africa, and just turn them loose. What would happen to them?

A. They are being dropped in a polar region as we find them in Africa?

Q. They would be transplanted to a polar region.

A. Well, without the equipment of civilization, they would perish.

Q. Then in simple language, can you say whether or not climatic conditions and supply of food and so forth have anything

to do with race formation?

- A. I don't quite understand this question, but I would like to return ----. If you place a person in an alien environment and instruct him in the requirements of survival there --- that he must hunt polar bear -- I think you would find your African population could develop skills and succeed in surviving to a certain extent by learning the tricks that are necessary to survive in that area. In the long run, however, -- not in the short term sense -- but in the long run, the Negro would be at a disadvantage in a polar region without the equipment of civilization. Some would probably survive, but a large number of Negroes would be weeded out, and the survivors would represent a new population, and this would be a population that possessed some genetic traits which would pass on to the next generation and ---

- Q. Let's get to the point. Over the hundreds of thousands of years, has Nature fashioned and formed races?

- A. Yes. Yes, by the process of selection.

- Q. What difference, briefly, has there been in the influences of Nature on those who were located in Africa -- as between those located in Africa and those located in the more frigid areas of the north?

- A. In other words, you are asking for a list of ----

- Q. Not a list; just some of them.

A. Well, in the sweat glands there would be different, more efficient means of regulating body heat, would be necessary.

Q. In Africa, you mean?

A. The disposal of excess heat would be necessary, and the conservation of body heat would be necessary in the polar region. One way by which this could be seen to by Nature would be the body size. Large animals which are found in the northern regions are warm-blooded animals because of the ratio of body surface to body volume is less, thereby the heat radiation would be less. Other means by which adjustment can be made to climate would include the ability to regulate the loss of heat in the skin by controlling the circulation. Now, there have been studies on Laplanders, aborigines and others, and search has been made, and there have been some physiological differences. Another means may be the utilization ----

Q. Are certain traits weeded out of the racial groups?

A. Yes.

Q. -- by reason of the climate, we'll say?

A. Yes, there are certain traits weeded out and certain traits concentrated in population. Favorable traits would be concentrated and favored.

Q. Now, are you familiar with the writings of Dr. Carleton Coon --

A. Yes.

Q. -- on that subject? Or is that a subject that he deals with?

A. Well, he deals with many subjects, but I think ---

Q. Are you familiar with his views on the effect of natural selection on the different races of mankind?

A. Well, his views are the common views in anthropology.

Q. Will you state briefly or read a brief excerpt that will illustrate what the views of Dr. Coon are, and then I will ask you who he is.

A. Dr. Coon, like other anthropologists, recognizes that we have various races, of various human types. These are types which are sufficiently different so that they must have been exposed to selective forces for a very long period of time.

Q. Do you have an article or a chapter by him entitled "Race and Ecology in Man"?

A. Yes, I do. I have a copy of this article.

Q. On Page 153 is there a brief statement by him on this subject that might be helpful in the record?

A. Well, he refers to the rate of change of different populations. Now, this is the statement. This, by the way, came from the Cold Spring Harbor Symposia on Quantitative Biology in the year 1960, and he states:

"There can be little doubt that human evolution proceeded during the latter part of the Pleistocene at an accelerated pace, particularly among Caucasoids and Mongoloids of the Palearctic region. One reason was the

changing ecological challenge which grew as culture accumulated, placing a continuous premium on certain unique human Cultures."

He states that a second reason was the small size of breeding population which allows genetic traits to be accumulated rapidly or lost rapidly; and small populations are easy to wipe out if they don't possess favorable genes, and they are also small enough to be successful and to thrive in competition with other small groups if they possess favorable genes.

He states the same thing in another article, in another volume, much the same way, but briefly he means that the challenges thrown at different populations in different regions differ, and he then states, or implies, that a challenging environment selects more beneficial genes, because a challenging environment tends to be unfavorable and you have a premium placed upon native intelligence, and this if it's absent or relatively absent in a group means that group is exposed to the risk of extinction, where if it's present then that trait is likely to be concentrated or accumulated in the population.

So he contrasts perhaps Ice Age Europe with its many challenges to, say, the more comfortable regions of Africa during the glacial era ----

Q. Let's get down to the issues here.

I'll ask you, first, who is Dr. Coon?

A. Dr. Coon is one of our most distinguished anthropologists, perhaps the foremost expert on European races, the author of many books.

Q. Where is he now?

A. Well, the last I heard he was ---

Q. --- Where was he when he wrote this book?

A. University of Pennsylvania. He was the curator of the museum and functioned there as the anthropologist.

Q. Is he recognized as an authority throughout the world?

A. Yes, he is.

Q. Now, have you read his views regarding the evolutionary development of the white and colored races?

A. That book, --In that current book which you have there he discussed the evolution of the various races, and he states that they underwent a separate but parallel evolution, and that they crossed the thresholds from primitive type of man, what is called homo erectus, to homo sapiens, modern type of man, at different periods in our pre-history; that the caucasian race made this evolutionary step over a quarter of a million years ago, 300,000 years ago, based upon the estimates of human type remains in Europe.

Q. By that ---

A. -- He states also, if I may finish, that the Negro made

this step thirty to forty thousand years ago, that there are no ancient Negro skeletons that are identified as modern Negroes in Africa before that time, though there has been a very intensive search.

So on these grounds he explains that there are separate lines of evolution leading to at least five races that he can distinguish.

And the mongoloid made this step, if I may include the third race, some time closer to the caucasian than to the Negro.

But each race is proceeding at a different pace of evolution, that the threshold was crossed, between a more primitive type of man and modern man, at different times in the past. This is the point of that book, if you want to read it.

Q. Do you have any short excerpts that illustrate your testimony? Turn to page 658 and 664.

A. Well, I have already cited his points, that the beginning of man was at least a half a million years ago, that we already had distinguishable geographic races, and that these races became sapiens, the modern type of man, at different periods of history. This is the quote on 658.

Q. Now, when you say "sapiens," in the language of the cotton market or the riverbank or a street corner, is that --- what does that mean?

A. That means, "sapiens" means "thinking man," which means modern

man. Of course, the thinking process was present before the homo sapiens; this is just a nomen term, part of the nomenclature of anthropology.

Q. He became what we recognize as a human being? Is that right?

A. That's right.

Q. Now, according to what you said, Coon says that the Caucasians became that a quarter of a million years ago, and the Negro became that around 40,000 years ago?

A. Yes.

Q. You agree with that?

A. I agree with this because it is the opinion of other respected anthropologists. Sir Arthur Keith has found a sharp separation between the primary races, and this separation is sharp enough to have required a great antiquity. R. Ruggles Gates and a number of other people very prominent in their thinking in this field, leaders in their thinking in this field, leading thinkers in these fields, likewise ascribe to this view, so that I think I would say that I accept it.

Q. Has any other anthropologist or any other authority accumulated as much evidence as Dr. Coon accumulated for his book on the origin of the races?

A. In this country, no. This is the life work of Professor Coon, and there is in this country no one, I think, that

would rank with him in his field.

Q. Now, let's leave for the moment the matter of race formation, and go to the question of race differences, and

I will ask you this question:

Are there any recognizable anatomical and physical differences between Negroes and whites that are significant for educational purposes? Now, we're not talking about psychological tests, but anatomical and physical characteristics.

A. Between Negro and white that are significant for education?

Q. Yes.

A. Anatomical?

Q. Yes.

A. I can think of nothing that would be visible. The ability to hold a pencil and to focus the eyes on the page, I think, are the minimum requirements.

Q. That is, if you stand them up side by side you don't see such differences. But when you make anatomical studies, microscopic studies, do you find those differences?

A. Well, no one has correlated microscopic structures with any that are anatomical in general with education. This is not a field that people are entering ---

Q. You mean that the brain of the Negro and the brain of the white man are not different?

A. No, I didn't say that. I'm speaking of visible gross

differences that are racial. There is nothing that one can point to that has any significance, to my knowledge, to proficiency in school subjects.

Now, if we are speaking of the brain, which is --- we are getting with another subject now. We can't tell a brain size by mere inspection of an individual. The thing has to be measured scientifically and sufficient sample has to be studied before conclusions can be drawn.

Q. Well, have you studied the brain, and are you a biochemist?

A. That is correct.

Q. Have you made chemical studies?

A. There are no biochemical studies on the brain. Racial ---

Q. What differences are there between the Negro and the white brain?

A. There are well known differences in size.

Q. Will you get into that? What are the differences?

A. Are you referring to the differences, or the differences, reported differences in size, or other differences besides size?

Q. We are starting with the size. What are the differences in size between the Negro and the white brain?

A. Well, there have been numerous studies on this subject, and the general opinion, current opinion, that any survey would substantiate is that there is about a ten percent difference in brain size, volume and in weight, between

the people of Caucasian origin and people of African origin, Negro Africans. This would be eight percent or twelve percent --- would vary from study to study depending on method and sample size, but it would tend to average about ten percent.

Q. Is it generally conceded among all scientists that the brain is the center of intelligence? The seat of intelligence?

A. That is correct. Yes.

Q. And does brain size, then, have any relation to intelligence?

A. Well, we know from several different types of study that this is correct. We know that in the process of evolution there has been an increase in brain. I think there is a chart here that was prepared; I don't know if we have to use it, but there is no doubt here that the progression upward from the great ape, the level of the great ape, to -----

Q. Turn the chart around.

A. I don't know how important it is to make reference to this chart, but we have here various classes of primitive human-like --- various prehistoric fossil types of men and also the great apes. And what this chart shows is that there is an increase in the cranial capacity measured from the reconstruction of the skulls from estimates, from the fragments that are found, and we see here that the further up we go toward modern man, the larger the brain presumably is. This is a sign of revolutionary progress. The more complex tasks

a person has to perform, the bigger the brain must be. Finally, we reach modern types of man, homo sapiens, and we find the largest capacity. Also we have a considerable range because in here is thrown together several types of man, several races. Our Neanderthal man looks rather large here; this is only because he had a large skull, but some of the things that we notice from the skull of Neanderthal indicate that though his brain may have been large in some ways it was primitive; certain regions of the brain in Neanderthal were less developed, though the size might have been -----

Q. Now, what does the scale at the bottom indicate?

A. This is capacity in cubic centimeters.

Q. Capacity in what?

A. This is the skull capacity, the volume.

Q. Well, is it in pounds?

A. It's a volume measure.

Q. Well, what's that "ccm"?

A. That's cubic centimeters.

Q. All right. And that "2000," is that 2000 cubic centimeters?

A. This I think would represent the extreme reported range of one or two individuals. The average homo sapiens ---

Q. Now, the great ape has from 300 to 700?

A. Yes.

Q. And then you move on to the Neanderthal man, that has a

capacity of, say, from 1100 to 1500 cubic centimeters?

And then the homo sapiens ranges from over a thousand to over 2000?

A . Yes.

Q. Go to the next chart. Explain what that represents.

A. This represents the volume of the cortex, the outer layer of the brain, which was here plotted against total volume in the brain. This is now in cubic millimeters, and it's in terms of a log.

Q. A what?

A. Logarithm. This is a device to make curved lines straight. But in any case, the progression here shows that the amount of cortex that we have relative to the amount of brain that we have increases as we progress upward from a very primitive form of primate-like animal to monkey to ape to man. This indicates the importance of the cortex, the outer layer of the brain, where we have the interconnection between the various nerve cells.

Q. What is the function of the outer layer, the cortex?

A. Well, the function is to integrate behavior, movement --- The nerve cell by itself can do nothing alone. It has to be connected with other nerve cells, and when you have these connections, they take place, send out to each other to a very considerable extent in the upper layer of the brain, the cortex, the gray matter, which is something that

we find increases throughout evolution, the relative amounts of it, and thereby this indicates the importance of it for complex function, including thought.

Q. Now, this graph --- It shows the growth as you go up in the evolutionary scale. Now, once you get to man, then there are variations, are there not, in the size of the brain and in the amount of cortex? Is that right?

A. Yes. Now, in size, in particular, we know this. The cortex, there are some estimates.

Q. All right. Go to the third chart there. Explain that chart, please.

A. This chart represents the region of development of the brain. This here is --- (Indicating)

Q. -- You are pointing at the first?

A. That's right. --- Tarsius.

This is a great ape --- (Indicating)

Q. Now, you are pointing to the middle one.

A. And this here is human.

Q. The first is the brain of what, now?

A. Tarsius. A primitive form of life which led to the monkey. It's a pre-monkey stage.

Q. Now, what does the dotted area represent in there, in the last two?

A. This area is really a region, in volume terms. The frontal lobe.

Q. What is the function of the frontal lobe?

A. This is believed to be the area of association where we have our higher activities, higher mental functions.

Q. Is that where the thinking is done?

A. That is one way of saying it yes.

Q. Is that where we organize materials in a case like this?

A. Yes.

Q. Is there any difference between the frontal lobe of the Caucasian and the frontal lobe of the Negro?

A. There has been some work on this and some reports indicate that we find smaller frontal lobe volume in the Negro.

This is the work of an anatomist called Bean that was published a number of years ago in a journal. I don't know, remember contains, what it actually in terms of numbers, but I have these citations here ---- but he reported frontal lobe area ----

Q. Do you have Bean's study?

A. Yes.

Q. You said there is a difference in brain weight between Negro brain and Caucasian brain, but you didn't say which one is bigger. Will you state for the record which one is bigger.

A. Which?

Q. Which is larger.

A. The Caucasian brain on the average is larger than the Negro brain.

Q. Now, do you have studies on that particular point?

A. Yes. I have here, I think, the most recent review of this.

subject and ---

Q. Do you have the one by Hambly?

A. This is the one I have here. This is the one published in 1947 in the Chicago Natural History Museum publication called *FIELDIANA ANTHROPOLOGY*. Hambly is the Curator, African Ethnology, there.

This is the most recent and comprehensive review of racial brain volumes or brain weights.

Q. What does it show, briefly?

A. This chart shows his last table, and he lists here measured capacity for different peoples.

Q. Will you please start at the top and read that chart for the record?

THE COURT: I suggest you stand on the side.

A. The top line here lists Europeans, ancient and modern. This is a collection of skulls.

Q. Let me ask you if that includes Caucasian?

A. That is Caucasian.

Q. Continue to interpret that chart.

A. And he lists after it the measured capacity of these European skulls, and he lists the volume he finds as 1488 centimeters.

Q. Is that the largest brain listed by Hambly in his study?

A. It is the largest average. This is a collection of ~~data~~ not

a single brain. This is a collection of numerous skulls; not a single one. The average for the European is the largest.

Q. All right, continue.

A. Below we have the Old English skull. These are ----

Q. Please read that chart.

A. "Old English." The volume here is "1472."

Q. What was the volume of the first one?

A. "1488." The difference is not significant, I don't believe.

We then come to "Miscellaneous Mongoloids." This is a grouping of several Mongoloid type people, and again we find a very sizeable cranial capacity. The actual number is 1465. One thousand four hundred sixty five ^{cubic} centimeters.

Below we have additional Mongoloids, the American Indian and Eskimo, and, likewise, their volume is sizeable, "1460 cubic centimeters.

We come to a specific population, Polynesians, and the volume is large, 1451.

We come to Fijians and Loyalty Islanders, 1439.

We come to the African Negroes, 1346.

Q. Now, what is the difference between the Negro and the Caucasian?

A. Well, not bothering to subtract, I would say about ten percent.

Q. Proceed.

A. Well, below we have Melanesians, and the Hindu and Tamil and ---

but we get down to the bottom and we ----

Q. --- Well, let's read them all, because that doesn't sound good in the record. You are now with the African Negro, 1346. Go on down from that.

A. The Melanesians. These are dark people living in New Guinea. We have a volume of 1345.

The Hindu and Tamil. These are populations of subcontinents of India; they measure 1335.

Now, we have additional Melanesians, and this population was found to be 1323 cc.

And Australian aborigines, 1294; and Tasmanians, 1256 cc.

Q. All right, you can take the stand again.

MR. PITTMAN: I tender for identity and for the record a copy of the study by Hambly from which that chart was made.

THE COURT: Let it be received in evidence and marked as an exhibit.

(Same received in evidence and marked as Intervenor's Exhibit No. 17)

Q. Is that representative of the studies, the number of studies, that have been made showing the relationship between the sizes of the brains of different peoples?

A. Yes, sir.

Q. Are you familiar with the writings of a man by the name of Boaz?

A. Yes, I read one of the works of Boaz.

- Q. I will ask you if Boaz is the man, the anthropologist, who was cited and most relied on in the book called THE AMERICAN DILEMMA by Myrdal, which was cited as an authority in Brown versus Board of Education?
- A. In Myrdal's book there are a number of different authorities and different contributors. Boaz was probably depended on rather heavily for his study for information regarding physical traits.
- Q. Now, I read to you from a book written by Boaz in 1911 entitled THE MIND OF PRIMITIVE MAN. About the brain. When I have finished, I will ask you some further questions about it. This is on, beginning on, page 24 of THE MIND OF PRIMITIVE MAN:

"We will now turn to the important subject of the size of the brain, which seems to be the one anatomical feature which bears directly upon the question at issue. It seems plausible that the greater the central nervous system, the higher the faculty of the race and the greater its aptitude to mental achievements. Let us review the known facts. Two methods are open for ascertaining the size of the central nervous system: the determination of the weight of the brain, and that of the capacity of the cranial cavity. The first of these methods is the one which promises the most accurate results. Naturally the number of Europeans whose brain weights have been taken is much larger than that of individuals of other races.

There are, however, sufficient data available to establish beyond a doubt the fact that the brain weight of the whites is larger than that of the most other races, particularly larger than that of the Negro. That of the white man is about 1360 grams. The investigations of the cranial capacities are quite in accord with these results. According to Topinard the capacity of the skull of males in the Neolithic period in Europe is about 1560 c.c.'s. That of the modern European is the same. Of the Mongoloid, 1510 c.c.'s. Of the African Negro, 1405 c.c.'s. And the Negroes of the Pacific Ocean, 1460 c.c.'s. Here we have therefore a decided difference in favor of the white race. In interpreting these facts, we must ask, Does the increase in the size of the brain prove an increase in faculties? This would seem highly probable, and facts may be adduced which speak in favor of this assumption. First among these is the relatively large size of the brain among the higher animals, and the still larger size in man. Furthermore, Manouvrier has measured the capacity of the skulls of 35 eminent men. He found that they averaged 1666 c.c.'s, as compared to 1560 c.c.'s general average, which was derived from 110 individuals. On the other hand, he found that the cranial capacity of 45 murderers was 1580 c.c.'s, also superior to the general average. The

same result has been obtained through weighing the brains of eminent men. The brains of 34 of these showed an average increase of 93 grams over the average brain weight of 1357 men. Another fact which may be adduced in favor of the theory that greater brains are accompanied by higher faculties is that the heads of the best English students are larger than those of the average class of student."

And then, further, I read this one thing:

"The increase of the size of the brain in the higher animals and the lack of development in microcephalic individuals are fundamental facts which make it more than probable that increased size of the brain causes increased faculties, although the relation is not quite as immediate as is often assumed."

Now, do you agree with that statement made by Boas in 1911?

A. Yes. I'm not familiar with the reference to the brain weight of the murderers, however.

Q. What's that?

A. He has a reference there on the brain volume or brain weight of a group of murderers. Now, the other portions of Boas's statement have been substantiated; there is general agreement; but I have no idea of anybody else studying the brain weight of murderers except that one

reference there.

Q. I see. All right. You have no knowledge of the brain weight of murderers as compared with others?

A. No knowledge.

Q. Now, do you have any recent studies, more recent than 1911, that prove what Boaz said then was the truth?

A. Well, other than the Hamby study, here is ---

Q. What about Pearl?

A. Other than the Hamby study there are several studies, and one is by Pearl, Raymond Pearl, who worked in the biology department of ---

Q. What's the date of that study?

A. 1934. He worked in the biology department of the School of Hygiene and Public Health, John Hopkins University.

Q. Since Dr. George testified about that and we will read his testimony, I won't ask you to go into detail, but I would like for you to tell who Pearl is and identify that for the record.

A. I identified him as a member of the faculty of John Hopkins University, and ---

Q. Is he an authority in the field?

A. Yes.

Q. MR. PITTMAN: May I identify that for the record, Your Honor, and tender it for admission, the study of Raymond Pearl?

THE COURT: Let it be received.

(Same received in evidence and marked as Intervenor's Exhibit No. 18)

Q. Now, do you have another study, by Gordon, "Amentia in the East African"?

A. Yes, I have a copy. This is H. L. Gordon, M. D., a publication in EUGENICS REVIEW, 1934.

Q. Does his finding accord with those of Hambley and Pearl and those recorded by Boaz in 1911?

A. Well, Gordon studied the weight of the African, various types of African Negro, measured the brain capacity. He then compared this capacity to reported values for Europeans.

This chart summarizes the numerical values he obtained. The European white, calculated by Berry, was 1481^{cubic}/centimeters, and the East African of various types -- their cranial capacity he found to be 1316, a difference of 165 cubic centimeters, and the percentage difference is 11 percent.

Q. 11.1?

A. This number is within the range usually found in comparative studies of volume or weight between white and Negro.

Q. Now, on yesterday were you present when I read an excerpt from Myrdal's book, saying to the effect that the difference between the weight of the white brain and the Negro brain was only slight?

A. Yes, sir.

Q. I will ask you if that percentage shown by the studies of Gordon is a slight difference or a materially substantial difference?

A. It is a substantial difference.

MR. PITTMAN: We now tender for identification into the record an article by H. L. Gordon entitled "Amentia in the East African," published in the *EUGENICS REVIEW*.

THE COURT: Let it be received in evidence.

(Same received in evidence and marked as Intervenor's Exhibit No. 19)

Q. Are you familiar with a work by a Dr. Reginald Ruggles Gates entitled "Human Genetics"?

A. Yes.

Q. Who was Gates?

A. Professor Gates was a very distinguished English biologist and geneticist. His period of research covered many decades; he was on many expeditions, made many studies on human populations, and was perhaps one of the foremost authorities in the world, we'll say, within the past 10 or 20, in human genetics.

Q. Do you have a photocopy before you of a portion of his work entitled "Human Genetics," Volume 2?

A. Yes.

Q. Page 1138 -- You may have a copy ---

A. I have a copy of it.

Q. Would you read what he has to say on that subject?

A. On the subject of brain -- Well, he cites Pearl and some

other studies, but his summary is as follows, on page 1138:

"...it seems difficult to avoid the conclusion that the brain of Negroes in America and of East Africans is some 10 percent less than in Europeans. This conclusion is unpalatable to those who affect to think that all races are equal in an evolutionary sense, but mere denial of the facts will no longer meet the case."

Q. Is that work in two volumes by Reginald Ruggles Gates on "Human Genetics" regarded as an authority in the field of genetics?

A. Well, I would say that it is very highly regarded.

Q. Is it used?

A. Yes. It was published in 1946 and not updated, but I would say copies of it are in use and much in demand.

MR. PITTMAN: We offer "Human Genetics" by Dr. Gates for identification into the record.

THE COURT: Let it be received in evidence.

(Same received in evidence and marked as Intervenor's Exhibit No . 20)

Q. Are you familiar with the writings of Professor Robert Bean? On the subject of the negro brain.

A. Yes.

Q. Do you have a copy of any of his writings?

A. I don't have a copy of Dr. Bean's work, no, but I have a small summary of it here. I made reference to it earlier, I believe.

Q. If you don't have a copy for the record, do you have before

you any summary from it or anything copied from it that would be useful to illustrate?

A. Yes. I have here some of the results.

Q. Will you state them for the record, if you agree with them?

A. This article was entitled "Some Racial Peculiarities of the Negro Brain, and appeared in the AMERICAN JOURNAL OF ANATOMY Volume 5, in 1906. This was a study of the American white and the American Negro, and Bean, as in other studies since cited, showed that there was a considerable weight difference between these races, so far as brain was concerned.

He also noted some differences in the corpus callosum. This is the tract which connects hemispheres. There was some difference in the shape. And from this, he concluded that there might have been functional differences in the association centers of the Negro brain.

Q. What is the date of that work?

A. 1906.

Q. Are the conclusions reached by him still valid, in your opinion?

A. I think they have been confirmed a number of times. There are some people who do not accept this work. There are some people who have confirmed it, and there are some people who have not found the same differences but have found other differences. I know that Bean reported the frontal lobe smaller. I mentioned that earlier, I believe. Others have not found this to be true, and again other experts have

confirmed it. There is some dispute on this. However, even in the case where confirmation of this one point was not made, other differences were found. The weight of the frontal lobe may not have been found different by other workers, but they may have ^{found} the dimensions to be different, or the height of the frontal lobe, or estimates of its development; but it's been confirmed in essence a number of times.

Q. Are you familiar with the studies conducted by Dr. Vint?

A. Yes, I am.

Q. Do you have a copy of any study made by him?

A. Dr. Vint published a report in the JOURNAL OF ANATOMY entitled "The Brain of the Kenya Native." That was published in 1954.

Q. Are you in agreement with his findings?

A. Well, he had several findings.

Q. That is, his conclusions from the findings.

A. Yes.

Q. Did he -- Were his findings with respect to brain morphology substantially the same as those made previously by others, anthropologists and ---?

A. By "morphology" you mean weight?

Q. Yes.

A. His weights were again ten percent different. He found some differences in grooving of the brain.

Q. Will you read his summary which appears on page 222 of

his article?

- A. (Reading) "1. The average weight of the brain of the Kenya native is 10.6 per cent or 152 gm. less than the average weight given for the brain of the European.

"2. No disproportion was found in the percentage weights of the fore-brain and the mid- and hind-brain in the native.

"3. A lunate sulcus was present in 70 percent of the brains examined, and there was a tendency to exposure of the insula.

"4. ---- "

Q. Tell us what the insula is?

- A. It's the lower portion of the brain. It would be hard to demonstrate, but this is not a major point. I think the next thing he comes to, with reference back to Bean, I think is important:

"4. The reduction in size of the native brain, as compared with the European, seems to be accounted for mainly by a failure in development in height."

That means that the native brain lacked development in the upward dimension, the frontal part. Then with reference back to Item 2, we found the weight difference in the fore-brain. This did not confirm Bean, but this other item, the failure of development of the upper dimension, the height dimension of the frontal lobe and frontal section of the brain, shows a difference again.

Q. Have you read the 4th item?

A. That was the 4th item, the height of the frontal region of the brain. Then the 5th item:

"5. The cortex of the native brain was found to be narrower than that of the European. This is true of all the individual laminae in the areas examined, except in the lamina zonalis, and in laminae 5 and 6 of the visuo-sensory area."

Q. What is the laminae of the brain?

A. Well, the cortex, the newer part of the cortex --- by "newer part" I mean the part that developed most recently in the animal kingdom --- called the isocortex -- this is the main covering of the brain. This is layered; there are six layers, and the importance of this is demonstrated by the fact that the higher up we go, the more developed these layers are, the more prominent they are, and the difference that Vint reports, he reports differences between various groupings of these layers. I'm not prepared to say anything about the importance of these different layers.

Q. That will be covered by some other evidence.

A. I do say in terms of numbers --- and he doesn't cite numbers -- there was a 15 percent difference.

Q. You say there is 15 percent difference in thickness?

A. Yes. He found the Negro brain was 15 percent thinner so far as the cortex was concerned, and this cortex was composed of six layers.

Q. Go ahead with the next one.

A. "6. The pyramidal cells of the supragranular cortex, and the Betz cells of the motor area, are smaller in the native brain than in the European.

"7. Cell counts per unit area are the same in the African and European brains."

Q. Now, when he says "cell counts per unit area," that means per square inch of area?

A. Well, when he sections the brain, he has a two-dimensional preparation. He can't count in depth; he can only count in surface. But this refers to the total volume. He would refer to a volume instead of an area. And what he is saying then is there are the same number of cells per unit volume in the region studied in the African and in the European.

Q. But the volume of the white is greater than the volume of the Negro brain?

A. Yes. And the cortical layers, which are the important layers, are also different.

MR. FITTMAN: We tender that article by Dr. Vint for identification in the record.

THE COURT: Let it be received.

(Same received in evidence and marked as Intervenor's Exhibit No. 21)

Q. Are you familiar with an article on a similar or related subject by Dr. James H. Sequeira, which was published in THE BRITISH MEDICAL JOURNAL, entitled "The Brain of the East

African native"? 1932, I believe, was the date of that article.

A. Yes, I have a copy.

Q. Very quickly, if you will, read that table showing brain weights discovered by him.

A. Well, the table begins with Caucasian, and it's placed at 1380 grams; Mongoloid placed at 1,300; East African at 1,280; Negroid at 1,240; the Australoid at 1,180.

Now, this table is obviously derived from several sources. I don't know where he gets it.

Q. I will ask you if that table shows substantially a ten percent difference?

A. Yes.

Q. -- In brain size.

A. It does.

Q. Now, I will ask you to look at his conclusion in the next column, the next to the last paragraph. Have you read those?

A. Yes, I have.

Q. Would you agree with it?

A. You want me to read it and then ---

Q. Yes. Read it. Read it aloud.

A. (Reading) "Educational authorities dealing with backward native races cannot afford to neglect the teachings of anthropology and psychology. If it is proved that the physical basis of 'mind' in the East African differs from that of the European, it seems quite possible that efforts

to educate these backward races on European lines will prove ineffective and possibly disastrous. It has long been recognized among highly civilized races that the educational methods applied to the normal child cannot be applied to the backward and defective."

Q. Do you agree with that, from all the studies you are familiar with?

A. I would say that there is a very considerable element of truth in this. There are many, many issues involved in this paragraph, however. Some of them are ---

Q. Well, we are trying them here today.

A. Some of them are not scientific. Some of them relate to educational theories. What this man is saying is that based on the work of Vint, there are differences in cortical layers. These cortical layers he relates to ability. Now, some of this is a sequence or construction of steps and sequences which is not always easy to follow. There is an area of knowledge here that is not sufficiently developed to come to a one hundred percent conclusion. I would agree with the general tone, but I don't say that the work it refers to is sufficient by itself to propose new theories of education or to bolster a single theory of education and make it the final dogma of the day. But in general I agree with this conclusion.

I may point out one thing, that this is an English M.D.

writing about another English M. D. and having in mind perhaps a different educational system, and dealing now with African education and English education. These are not quite the same. And I don't know what type of education they were giving in East Africa.

Q. He was more familiar with the traditions in Africa than you are, was he not?

A. That is correct.

Q. He had been there and made the study, had he not?

A. That is right.

Q. And he came to the conclusion that you couldn't educate them together?

A. This is the opinion of this man. This did come from Africa, yes.

Q. Do you have any reason to question it?

A. I don't question it, but I find that I don't necessary---- I don't take issue with him if he disagrees with the educational system in Kenya. I wonder, however, what else one brings to this subject before one comes to a conclusion. Now, he brings Vint's work in. This by itself would seem sufficient to me to ---

Q. I didn't ask you that. Isn't this in accord with general authorities in the field?

MR. BEEL: Your Honor, I don't know that this is necessary. This is an expert witness; I don't think counsel should put words in his mouth. Let him state the true facts

as he understands them. I object to him leading the witness.

THE COURT: Yes. Don't lead the witness.

MR. PITTMAN: Well, I tender this for the record and into evidence as an authoritative statement based upon the studies made by others.

MR. BELL: I don't know that he said it is. I couldn't understand what his explanation of it was.

MR. PITTMAN: Well, I withdrew the testimony of this witness, then, with respect to it.

MR. WITNESS: Did I make myself clear when I said that I cannot agree with an M. D. discussing the educational situation of Africa if he is deciding that upon one anthropological study or histological study? This is taking too little and making too much. This is my opinion. But in the larger context with other evidence, then perhaps it might be permissible to say something on this subject.

Q. Then, Doctor, we go to this. I see your point. Your point is that based upon one study you wouldn't draw such a conclusion?

A. No.

Q. All right. Based upon all the studies that have been made as to brain size and brain structure, what is your conclusion with respect to the educability of the Negro as compared with the Caucasian?

A. I would say that based upon these differences, we would find these physical traits, these anatomical traits, reflected

in intellectual function, which in turn would be reflected in ability to learn, which is, of course, the process we are encouraging in school. This would be the sequence as I see it.

Q. All right.

MR. PITTMAN: We tender this for the record and into evidence.

THE COURT: Let it be received in evidence.

(Same received in evidence and marked as Intervenor's Exhibit No. 22)

Q. Were you present yesterday when an excerpt was read from the record in the Brown case from the evidence of Dr. Redfield from the University of Chicago, which was to the general effect that no differences have been found, no substantial differences have ever been found in the educability or the mental capacity between the Negroes and the whites, and that if such differences should ever be found they would not prove to be of consequence? Were you here?

A. I seem to remember that, yes. And I think I have read it before.

Q. Are you familiar with the writings of Dr. Lewis S. D. Leakey, who deals with that subject in a work written in 1961, entitled "The Progress and Evolution of Man in Africa"?

A. Yes, I have read that book. I am familiar with that work.

Q. Will you read, or do you consider that book authoritative?

A. Dr. Leakey is one of a group of three workers in South Africa

of international reputation, and I would regard him as a leading authority, yes, and I regard all his work as being distinguished in quality.

Q. What do you have before you of his writings on the subject testified to by Redfield in the Brown case?

A. Leakey made several very interesting statements, but the one here of import is as follows:

"As a social anthropologist, I naturally accept and even stress the fact that there are major differences, both mental and psychological, which separate the different races of mankind. Indeed, I would be inclined to suggest that however great may be the physical differences between such races as the European and the Negro, the mental and psychological differences are still greater."

That's the close of that quotation.

Q. Are you in agreement with that statement?

A. Yes. This would be in harmony with everything I have said.

MR. PITTMAN: You may question him.

THE COURT: Any questions by the defendants?

Any cross examination?

MR. BELL: No, Your Honor. We move to strike the testimony on the basis it is irrelevant, and we further move the Court to strike it on the basis of its weight as evidence in this case.

THE COURT: For the reasons heretofore stated, I will overrule the motion. (Witness excused)

MR. PITMAN: Dr. George of the University of North Carolina testified in two cases previously. He is a biologist. At this time his wife is ill and in the hospital, yet he was coming anyway; but then his daughter was to remain with his wife and his son-in-law became ill and was put in the hospital; and he could not come.

But Dr. Hoy is here from the University of South Carolina. He has taught biology there a number of years. He has heard and has read the testimony of Dr. George, and we would like, in the economy of time rather than to question Dr. Hoy independently, to have him take the stand and for us to read to him the questions asked Dr. George, and let him read the answers of Dr. George. In that way, we can cut down and shorten the time. That has been done before.

MR. BELL: Counsel for plaintiffs are quite familiar with Dr. George's testimony, both in the Stell case and as it appeared in several other cases. Subject to the same objection, we have no objection to permitting that testimony to be read into evidence. And with the further idea of economy of time, we would be quite willing to make stipulation that the expertise of Dr. Hoy, which I would not question, would support the statement of Dr. George, without putting him on the stand and having him read all of this in the record.

THE COURT: Very well. I think that would be good pro-